Claims

1. An object surface characterization system with adaptive lighting control, the system comprising:

a light projector;

a light source;

a camera;

a processor coupled to the light projector, the light source and the camera; and

a memory subsystem coupled to the processor, the memory subsystem storing code that when executed by the processor instructs the processor to perform the steps of:

controlling the light projector to selectively provide a plurality of light beams arranged in a beam matrix of rows and columns, wherein the light beams impinge on a surface of a target and are reflected from the surface of the target;

controlling the light source to selectively illuminate the surface of the target;

directing the camera to capture a first image frame and a second image frame, wherein the first image frame includes contributions provided by the light source and the plurality of light beams of the beam matrix after reflection from the surface of the target, and wherein the second image frame include contributions provided by the light source after reflection from the surface of the target;

examining at least a portion of the first and second image frames to provide an indication of the intensities of the plurality of light beams and the light source; and

controlling a camera integration time of the camera and a pulse width of the light source based upon the intensities of the plurality of light beams and the light source to achieve a desired target illumination.

2. The system of claim 1, wherein the light source includes at least one light emitting diode (LED) and the light projector includes a laser and a diffraction grating.

3. The system of claim 2, wherein the light source includes a diffuser positioned between the LED and the target.

4. The system of claim 1, wherein the camera includes a near infrared (NIR) filter positioned between the camera and the target.

5. The system of claim 1, wherein a size of at least one of the light beams provides an indication of the intensity of light provided by the light projector.

6. The system of claim 1, wherein the portion of the first and second image frames that is examined includes an area that is defined by the plurality of light beams in the first image frame.

7. The system of claim 1, the memory subsystem storing additional code that when executed by the processor instructs the processor to perform the additional steps of:

determining an intensity differential between the first and second image frames;

estimating the light source intensity based upon the intensity of the second image frame; and

estimating the light projector intensity based upon the intensity differential between the first and second image frames.

8. A method for providing an object surface characterization system with adaptive lighting control, comprising the steps of:

controlling a light projector to selectively provide a plurality of light beams arranged in a beam matrix of rows and columns, wherein the light beams impinge on a surface of a target and are reflected from the surface of the target;

controlling a light source to selectively illuminate the surface of the target;

directing a camera to capture a first image frame and a second image frame, wherein the first image frame includes contributions provided by the light source and the plurality of light beams of the beam matrix after reflection from the surface of the target, and wherein the second image frame include contributions provided by the light source after reflection from the surface of the target;

examining at least a portion of the first and second image frames to provide an indication of the intensities of the plurality of light beams and the light source; and

controlling a camera integration time of the camera and a pulse width of the light source based upon the intensities of the plurality of light beams and the light source to achieve a desired target illumination.

9. The method of claim 8, wherein the light source includes at least one light emitting diode (LED) and the light projector includes a laser and a diffraction grating.

10. The method of claim 9, wherein the light source includes a diffuser positioned between the LED and the target.

11. The method of claim 8, wherein the camera includes a near infrared (NIR) filter positioned between the camera and the target.

12. The method of claim 8, wherein a size of at least one of the light beams provides an indication of the intensity of light provided by the light projector.

13. The method of claim 8, wherein the portion of the first and second image frames that is examined includes an area that is defined by the plurality of light beams in the first image frame.

14. The method of claim 8, further comprising the steps of:

determining an intensity differential between the first and second image frames;

estimating the light source intensity based upon the intensity of the second image frame; and

estimating the light projector intensity based upon the intensity differential between the first and second image frames.

15. An object surface characterization system with adaptive lighting control, the system comprising:

a light projector;

a light source;

a camera;

a processor coupled to the light projector, the light source and the camera; and

a memory subsystem coupled to the processor, the memory subsystem storing code that when executed by the processor instructs the processor to perform the steps of:

controlling the light projector to selectively provide a plurality of light beams arranged in a beam matrix of rows and columns, wherein the light beams impinge on a surface of a target and are reflected from the surface of the target;

controlling the light source to selectively illuminate the surface of the target;

directing the camera to capture a first image frame and a second image frame, wherein the first image frame includes contributions provided by the light source and the plurality of light beams of the beam matrix after reflection from the surface of the target, and wherein the second image frame include contributions provided by the light source after reflection from the surface of the target;

examining at least a portion of the first and second image frames to provide an indication of the intensities of the plurality of light beams and the light source; and

controlling a camera integration time of the camera and a pulse width of the light source based upon the intensities of the plurality of light beams and the light source to achieve a desired target illumination, wherein the light source includes at least one light emitting diode (LED) and the light projector includes a laser and a diffraction grating.

16. The system of claim 15, wherein the light source includes a diffuser positioned between the LED and the target.

17. The system of claim 15, wherein the camera includes a near infrared (NIR) filter positioned between the camera and the target.

18. The system of claim 15, wherein a size of at least one of the light beams provides an indication of the intensity of light provided by the light projector.

19. The system of claim 15, wherein the portion of the first and second image frames that is examined includes an area that is defined by the plurality of light beams in the first image frame.

20. The system of claim 15, the memory subsystem storing additional code that when executed by the processor instructs the processor to perform the additional steps of:

determining an intensity differential between the first and second image frames;

estimating the light source intensity based upon the intensity of the second image frame; and

estimating the light projector intensity based upon the intensity differential between the first and second image frames.